

Abstract of paper proposed for presentation at
1994 IEEE International Electron Devices Meeting
December 11-14, 1994, San Francisco, CA

THE CASSINI MISSION Ka-BAND TWT

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ABSTRACT

A 10 watt, 32 GHz TWT has been developed and space-qualified for delivery to the Jet Propulsion Laboratory (JPL) for incorporation into the Ka-Band Transmitter Package for the Cassini Mission. The program is a collaboration between NASA Lewis Research Center (LeRC), Hughes Electron Dynamics Division, and JPL. The Cassini Mission is planned for launch to the environment of Saturn in 1997.

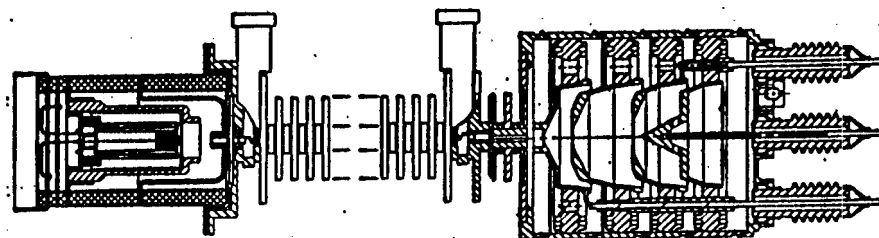
The TWT, designated Hughes 955H, has demonstrated an overall saturated efficiency in excess of 40 percent. To achieve this performance, several LeRC-developed technologies, including computer-aided advanced designs of the helix and the multistage depressed collector (MDC), along with suppression of secondary electron emission from the MDC electrodes, were incorporated into the TWT design. More specifically, the helix for the TWT's output section was designed at LeRC to include an advanced dynamic velocity taper. This "tapering" is a continuous, nonlinear reduction in pitch with output section length to slow the circuit wave and enhance synchronization between the circuit wave and the electron beam. The MDC design, also performed at LeRC, predicted spent-beam electron trajectories to identify effective electrode geometries and spacings. This design included the effects of secondary electron emission characteristics of the electrode surfaces. Further, the MDC employs oxygen-free, high-conductivity copper electrodes that were treated at LeRC for secondary electron emission suppression by means of an ion-bombardment process.

An Engineering Model TWT and two Flight Model TWT's have been packaged and tested for delivery to JPL. The production of flight hardware as a part of a program which originally was intended as a research effort has resulted in reduced overall costs and a reduced delivery schedule.

The proposed presentation will include a description of the TWT construction and MDC electrode surface treatment as well as detailed performance characteristics and current status of the Engineering Model and Flight Model TWT's.

REFERENCE: Curren, A.: et al.: A Low-Power, High-Efficiency Ka-Band TWT.
AIAA Paper 92-1822, 1992.

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Suggested area: Vacuum Electronics.

955H KA-BAND TWT DESIGN FEATURES

ELECTRON GUN

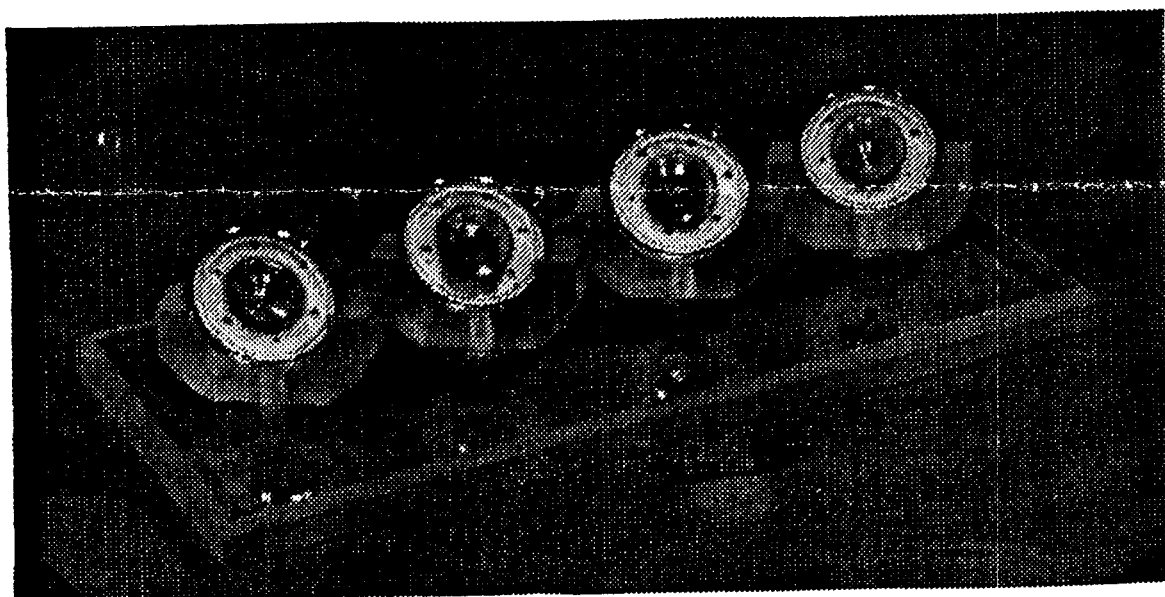
- EXCELLENT FOCUSING
- -LOW BEAM INTERCEPTION
- LESS THAN 3.5 WHEATER POWER
- AC HEATER

COLLECTOR

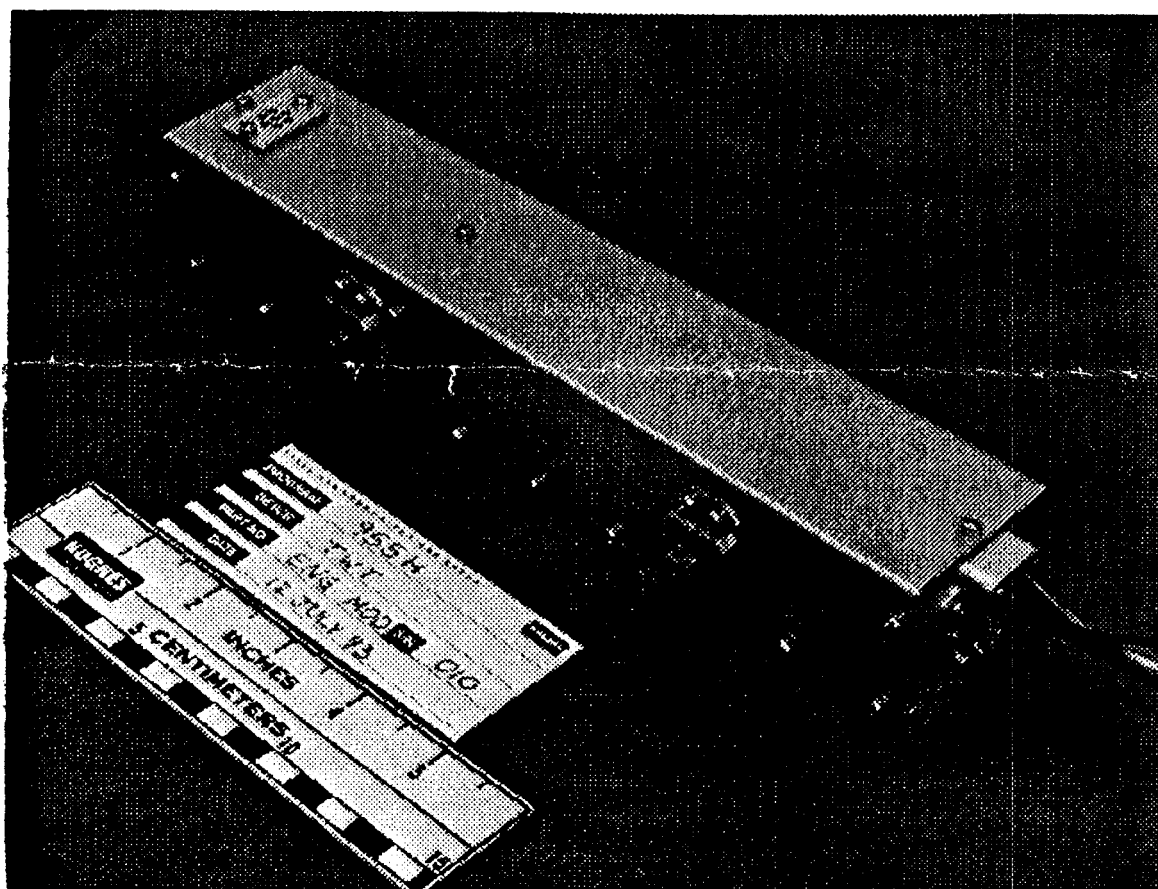
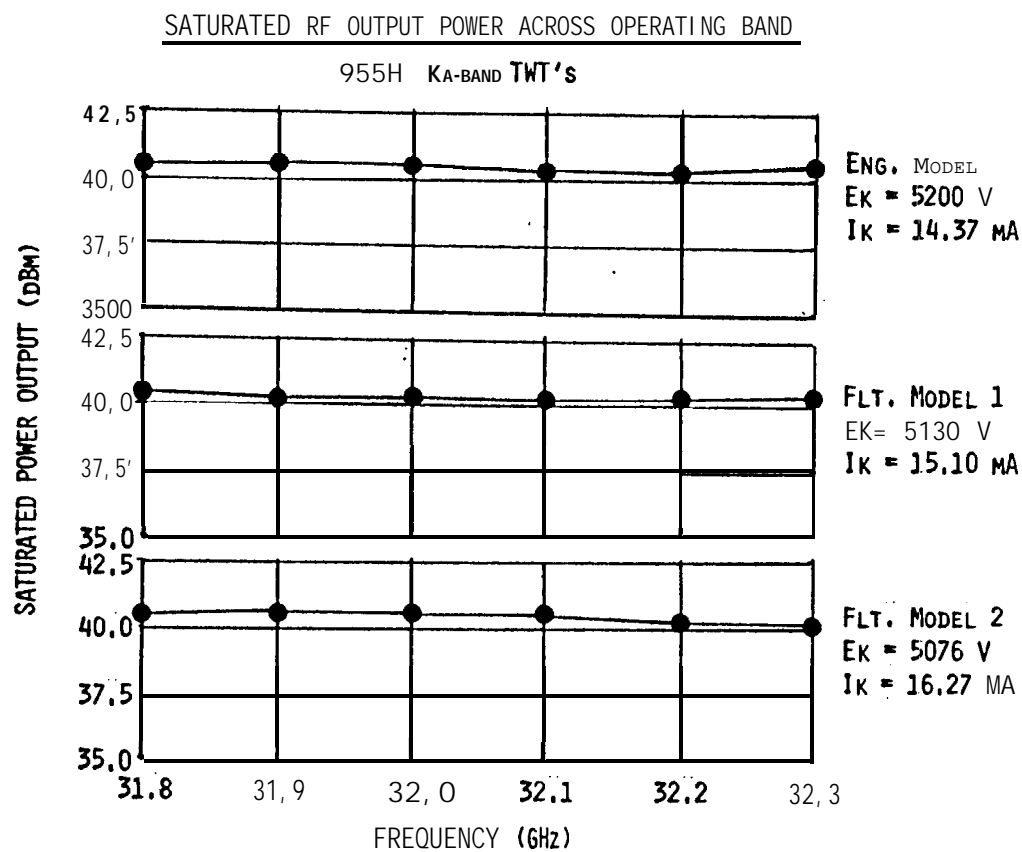
- 4-STAGE MODULAR DESIGN
- -OFHC COPPER ELECTRODES
- -ELECTRODES TREATED FOR REDUCED SECONDARY ELECTRON EMISSION

CIRCUIT & BODY

- PBN RODS
- -ALIGNED FOR LOW DIELECTRIC LOADING
- -DESIGNED FOR HIGH EFFICIENCY
- COPPER-PLATED TUNGSTEN HELIX
- -LOSS ABOUT 2.36 DB/IN
- SHORT-PITCH POLE-PIECE DESIGN
- -IMPROVED FOCUSING OPTIMIZATION
- -BEAM REFOCUSING SECTION
- -IMPROVED COLLECTION CAPABILITY



UNTREATED MDC ELECTRODES FOR 955H Ka-BAND TWT



FLIGHT-PACKAGED 955H Ka-BAND TWT